ELTEC

Traffic Products and Warning Systems

SOLAR SYSTEMS

INSTALLATION AND OPERATION MANUAL

www.ELTECCORP.com

Part No. 0SOLAR **Rev. 0715A**

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INTRODUCTION

Solar power is a reliable, efficient, and effective method to power either Alternating Current (AC) or Direct Current (DC) loads. Since solar power systems provide DC current, DC outputs for DC loads are more efficient.

A solar system consists of three (3) major subsystems: the solar panels which convert solar energy to electrical energy, the batteries which store the electrical energy and release it on demand, and the load—the components that are being powered by the batteries.

Each system provided by Electrotechnics Corporation (ELTEC) has been sized for the specific application specified by the end user. We have considered the power consumed by the load, the power generated by the solar panels, and the geographic location of the installation.

Advantages of solar power systems include:

- Clean efficient power that does not generate pollutants
- Reliability of continuous power without worry about brown/blackouts
- Easy installation since conduits and power lines are not required
- No monthly utility bills

All equipment provided is standard, easily replaced if required. Your system is pre-wired to the maximum extent possible for easy assembly and installation.

Appendix A describes critical parameters that you should ensure are met during the installation. These parameters include solar panel tilt angle, system designation, and solar panel azimuth. In order to facilitate assistance, you should make note of your system parameters and checks.

If you experience difficulty during the installation or during operation of your solar system, call ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com for assistance.

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LIMITED WARRANTY

Electrotechnics Corporation (ELTEC) warrants your solar device to be free of defects in material and workmanship for a period of 25 months from the shipping/invoice date.

This warranty is valid for systems that are used within the design specifications originally submitted by the end customer. Systems used for periods longer than specified or with loads greater than specified, void the warranty. Systems not installed properly can also void the warranty. Some examples of improper installation include excessive shading, incorrect azimuth, and incorrect tilt angles. These examples are not inclusive. Misuse, abuse, physical damage and/or acts of God to the equipment are not covered by the warranty.

Electrotechnics Corporation will, at its discretion, repair system components returned with prior merchandise authorization (RMA) or refund the customer's money. In no event will Electrotechnics Corporation or its employees be liable for any direct, indirect, special, incidental, or consequential damages.

Some components used by Electrotechnics Corporation have warranty longer than the 25 month period specified by Electrotechnics Corporation. Following this 25 month period, Electrotechnics Corporation will, when practical, assist the customer in obtaining repair and/or service for these warranted components.

Electrotechnics Corporation wishes to provide exceptional service to our customers. Every effort will be made to ensure that your products are within specification and free from manufacturing defect.

SYSTEM CONFIGURATION

A typical system will consist of a cabinet, battery(s), solar controller, solar panel(s) with mounting rack, and pole. All solar powered systems are sized for each project taking into consideration the hours of operation, latitude, local site conditions, and weather ensuring sufficient power during winter months. If your application is a traffic warning system you will have a solid state DC flasher and LED beacons. If the application is for a school zone warning beacon system, a time clock will also be provided.

Refer to Figure 1 for a typical traffic warning solar system using 2 LED flashing beacons. Figure 2 depicts a typical control panel configuration for a school zone flasher. Figure 3 depicts a typical control panel for 24-Hour flashing beacons.

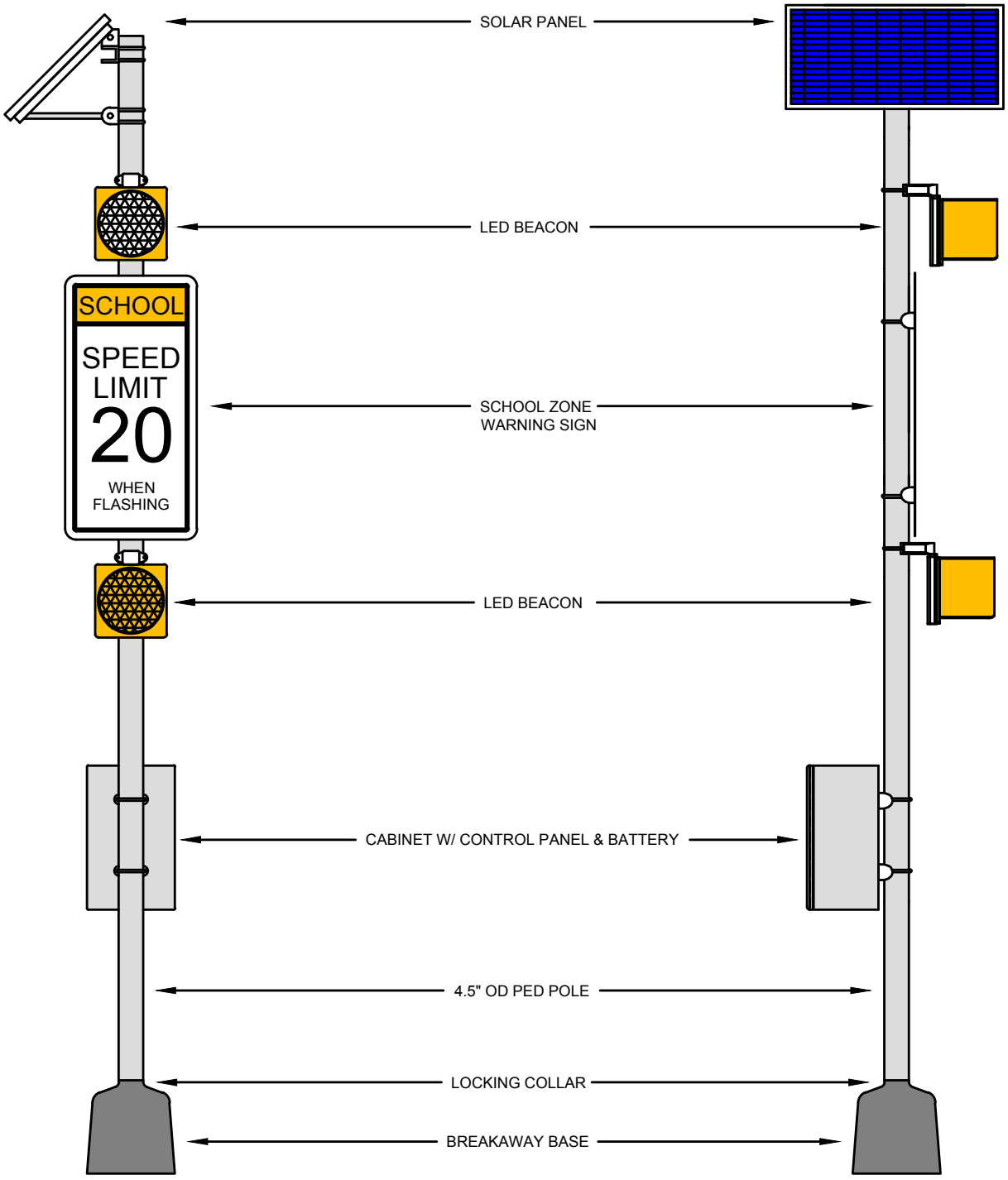


Figure 1 - Typical Traffic Warning Solar System (School Zone)

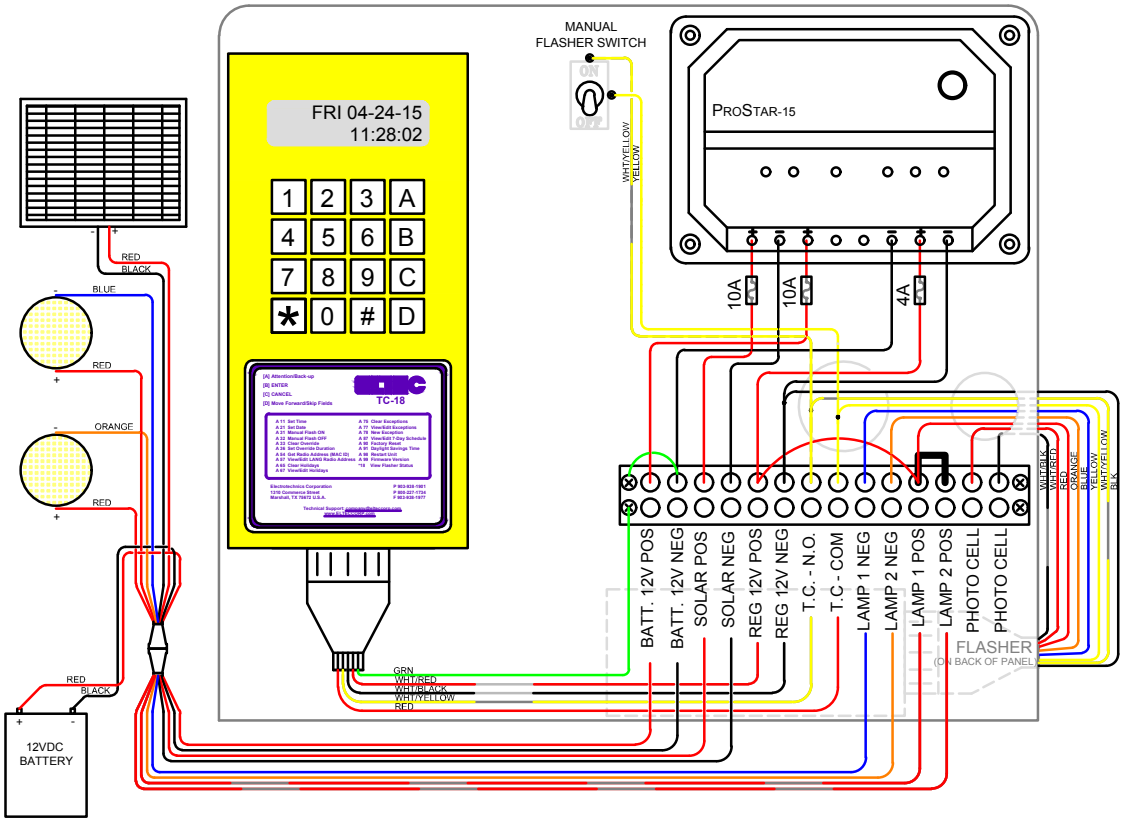


Figure 2 - Standard Control Panel Schematic (School Zone)

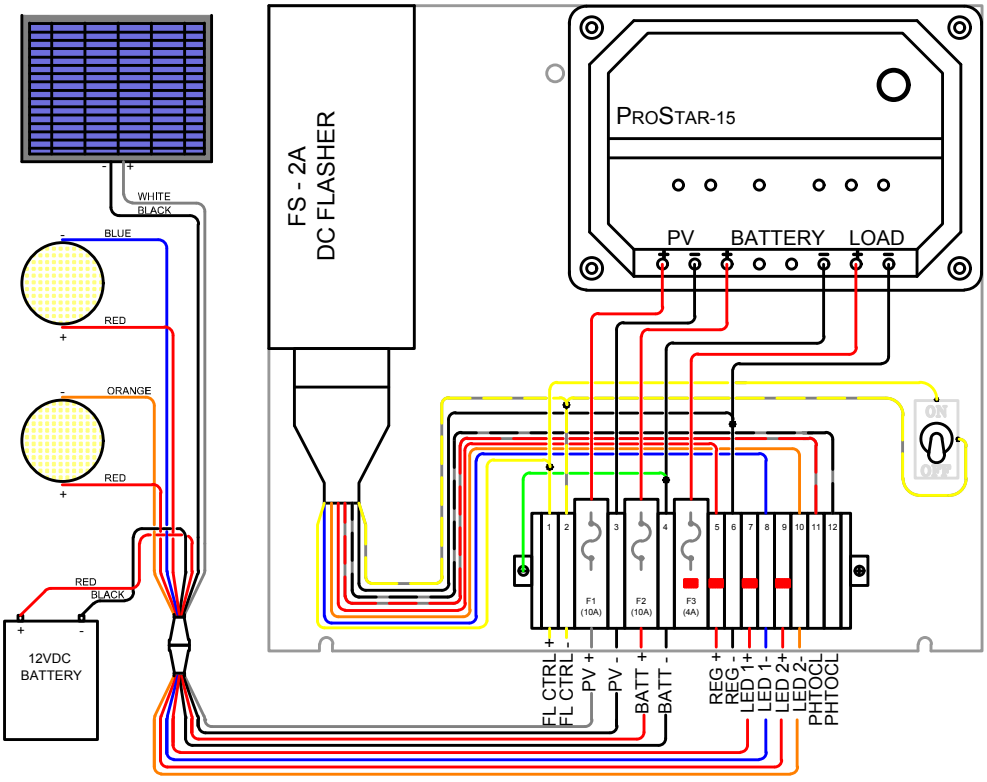


Figure 3 - Standard 24-Hour Control Panel Schematic

Section 1
System Operation

Summary

Sunlight is converted by the solar panels to electrical energy while the batteries store the electrical energy. The solar panels are connected to the batteries through a controller which controls the charging and discharging rate of the batteries. For school zone systems, the time clock controls the time that power is applied to signals, radar signs, etc. If the system is a 24-Hour flashing beacon system then no time clock is needed. A solid state DC flasher is used to switch power from one beacon to the other creating an alternating flash. If the system does not require an alternating flash, then no flasher is provided.

The load is always powered from the batteries via the controller, never from the solar panels directly. Each of these major components is described in more detail.

Solar Panel(s)

The solar panel(s) are warranted for 20 years. A single panel can range be from 40 to 140 watts. Depending on your system requirements you may have multiple panels. Appendix B describes the solar panel in more detail.

Charge Controller

The charge controller functions to control the charge on the batteries. The ProStar and SunSaver controllers are solid state devices which control the charging and discharging of the batteries. Controllers provide temperature compensated charging so that the rate of charge is controlled for both temperature and state of charge. The controller will shut off charging when the battery reaches a charge of 13.7 VDC. The controller will disconnect the load when the battery voltage reaches 11.4 VDC. These set points have been established to prevent damage to the battery from an overcharge condition or a low voltage condition. The controller also has a manual disconnect switch that allows you to electrically disconnect the batteries from the system.

The ProStar controller provides a LCD display that cycles through battery voltage, solar panel current, and load current. SunSaver controllers use three (3) colored LEDs to indicate conditions.

Flasher

The ELTEC model FS-2A is a 12/24 VDC, solid state flasher that consumes negligible power during operation. The flasher is set at the factory to provide 50 flashes per minute, for 1 or 2 circuit operation (depending on system configuration), and a 50% duty cycle. For the dimming circuit to work a photocell must be installed. Photocells should be positioned where street lamps and traffic lights do not affect them.

Refer to Appendix E for the FS-2A specifications and warranty.

Battery

The battery stores the electrical energy which powers the load. Batteries are maintenance-free sealed gel or absorbed glass mat (AGM) technology. If your system is ‘knocked down’ by accident and your battery punctured, you will experience little to no acid spilled due to the sealed gel and AGM technology.

Time Clock (School Zone)

The time clock is a solid state, programmable device that controls the operation of the load based on the program entered. The time clock automatically compensates for daylight savings time and leap year. The daylight savings time feature can be disabled at the user’s discretion. The time clock is rated at 15 amps per circuit and operates on 12 VDC. Time clocks usually have one relay but can be preassembled with 2 or 4 relays upon request. ELTEC manufactures the following time clock models—TC-3000, TC-18, and NTC-17E.

Beacons

Flashing beacon systems can be configured in single, double, or multiple arrays. Standard sizes are 8 or 12 inches in diameter. Standard colors are amber and/or red.

Terminal Blocks and Circular Pin Connectors (CPC)

Fully labeled terminal blocks are provided to facilitate termination of solar panels, batteries, and various external components. Power terminals will be clearly identified as to positive (+) or negative (-). Most systems are pre-wired with circular pin connectors for ease of component replacement (see Figures 4 and 5).

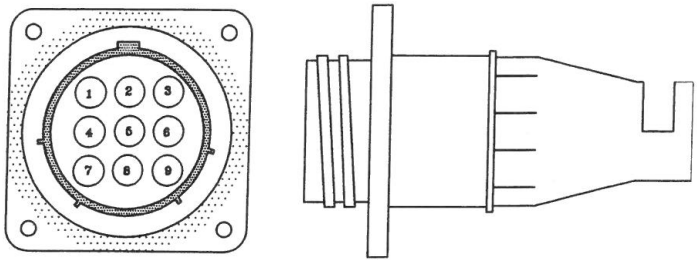


Figure 4 - Male CPC END
(Attached to Cabinet Terminal Block Wires)

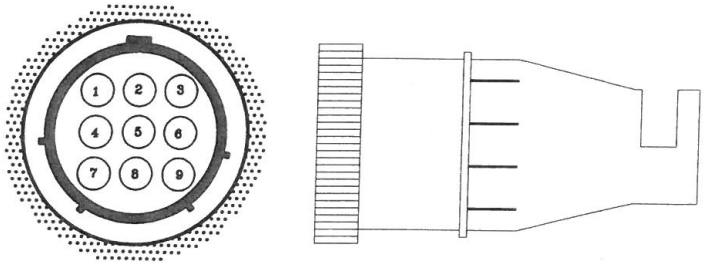


Figure 5 - Female Backbone CPC END
(Attached to Solar Panel, Battery, and LED Wires)

Power Inverters

Solar powered systems can be properly sized to provide AC load power when needed. The end user may need to power an AC component ranging from 120 to 12 VAC. If you specify a requirement for AC load power, your solar system will have an inverter installed.

Section 2

Installation

CAUTION: THESE INSTRUCTIONS ARE FOR GUIDANCE ONLY AND ARE NOT TO BE CONSTRUED AS ENGINEERING APPROVED DOCUMENTS. YOU SHOULD CONSULT A LICENSED PROFESSIONAL ENGINEER FOR APPROVAL OF YOUR SITE AND ERECTION PLANS.

Foundation

It is important that a proper foundation be prepared. Appendix C shows a typical foundation. Your installation will be subject to winds and other environmental considerations, so a proper foundation is critical to the successful and correct installation of your solar equipment.

Installation of Base Assembly

Most installations will use a breakaway base. The base should be installed on a level surface. If the surface is not level, use leveling processes such as grout, shims, or similar tools to level the foundation surface. Your foundation should have four (4) anchor bolts installed when the foundation is prepared. These anchor bolts are usually ¾" x 18" J-bolts that come with your breakaway base. Anchor cages are also available for foundations which include a vertical rebar assembly (See Appendix C).

Preparation of Pole

Normally the pole is prepared before it is erected. When you receive the pole, it typically does not have any mounting holes. You will need to drill the mounting holes in the desired locations.

Tools required:

- Drill and unibit or hole saws (ranging from ¾" to 1¼")
- Fish tape to fish the leads through the pole
- De-burring file
- Pipe wrench
- Measuring tape
- Hammer

The user must decide upon the desired mounting of the cabinet and beacon(s). Typically the cabinet is on one side of the pole with the beacon(s) on the opposite side. Unless the user is concerned about vandalism, we suggest that the cabinet be mounted so that the control panel in the cabinet is eye level. The control panel shelf is approximately 15 to 30 inches from the bottom of the cabinet. The leads from the solar panel and from the LED(s) (the 'backbone' harness assembly) will enter the cabinet from inside the pole through the mounting bracket on the back of the battery cabinet. We suggest that the user drill the cabinet lead entry hole approximately 4 to 4½ feet from the bottom (threaded end) of the pole. The base is approximately 14 inches high; thus a hole 4½ feet from the bottom will place the control panel shelf approximately 5½ feet above the foundation. This drill hole should be 1 inch in diameter.

If vandalism is an issue, the user may want to mount the battery cabinet at a height so that it is only reachable with a lift bucket truck. In this instance, the user will want to ensure that the top of the battery cabinet does not interfere with the tilt of the solar panels. We suggest that the user drill the hole for the leads 9 feet from the bottom of the pole. This will place the control panel shelf at approximately 10 feet above the foundation and the base of a 2 battery cabinet approximately 9 feet above the foundation. The base of a 4 battery cabinet will be approximately 8 feet above the foundation.

The next step is to drill the holes for the leads leading to the LED(s). Remember that normally the LED(s) are on the opposite side of the pole from the battery cabinet. If a single LED is being used, it typically goes above the

sign. Your local highway or street codes will specify how high the LED(s) will be above the foundation.

NOTE: When measuring the pole to drill the LED lead holes, remember that the base adds approximately 14 inches to the height of the hole above the foundation.

If an acorn cap is provided for the top of the pole, the user must drill an exit hole near the top of the pole for the solar panel leads. We suggest a ¾" hole for these leads. This hole should be approximately 9 to 12 inches below the top of the pole.

All holes should be de-burred to ensure that chaffing or cutting of harness insulation does not occur. ELTEC harnesses come with a circular pin connector for easy mating to the back of the control panel. It will be necessary to fish the harness through the pole before erecting it.

Mount the cabinet onto the pole using the U-bolts provided for the mounting bracket(s) on the back of the cabinet. If instead of mounting brackets with U-bolts, you are provided brackets for banding, band the cabinet to the pole. Remember the hole in the bracket should be directly over the hole that you have drilled in the cabinet.

Thread the leads of the backbone harness into the pole from inside the cabinet. The leads of the backbone harness will go through the hole in the back of the cabinet, through the mounting bracket, and through the hole drilled in the pole. Using the fish tape, pull the LED(s) leads to the hole(s) for the LED(s) and pull the solar panel leads (the jacketed grey cable) out the top of the pole – either through the end of the pole or through the hole if one was drilled.

If an acorn cap was provided for the top, install the cap.

At this point you should have the backbone harness circular pin connector extended from the hole for the battery cabinet (inside the battery cabinet), the LED leads through the LED(s) (as well as the jumper if it is a 2 LED assembly) and the solar leads from the top of the pole.

You may want to install the solar panel(s) and mounting rack prior to installing the pole in the base. If so skip to the section 'Installing the Solar Panel(s) and Mounting Rack'. After completing the installation of the solar panel(s) and mounting rack, then return to section 'Installing the Pole'. Be careful that you do not damage the solar panel(s).

Installing the Pole

Raise the pole over the base and thread the pole into the base. Tighten the pole so that it is secure. Assure that the final position of the pole will be with the holes for the LEDs facing the oncoming traffic.

Most units will be provided with a base collar. Install the collar around the pole and secure it to the base.

Installing the Solar Panel(s) and Mounting Rack

Warning: To avoid electrical shock while installing and connecting the solar panels, remove the PV fuses in the control cabinet.

Important: Your solar panel is designed to convert sunlight into electrical energy. Your panel should be located so that it is exposed to the sun at all times and is not shaded by trees, buildings, or similar things.

Instruction sheets for assembling and installing the mounting rack will be found in an envelope with the mounting rack. If instructions are not provided, please call ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@eltеccorp.com and they will be sent to you.

Tools you will need are:

- Flat head screwdriver
- Compass
- Protractor
- Ball peen hammer

Attach the solar panel(s) to the mounting rack. Instructions should be in the solar panel box. If they are not, and you need instructions, please contact ELTEC as previously discussed.

You are now ready to install the mounting rack with solar panels on the pole. If the mounting rack has U-bolts, it goes near the top of the pole, just under the pole cap. If the mounting rack is a post top style using a slip fitter cap, slip and fasten the cap over the top of the pole. If it is a side-of-pole mounting rack, follow the rack installation instructions. The orientation of the solar panels should be South.

To optimize the generation of electricity, your system should be optimized for your location. You must rotate the panels from horizontal to the optimal angle. Use Appendix B to determine the angle. Use a protractor to tilt the solar panels until they are at this angle. Tighten the nuts on the bolt to lock panels in place.

Locate the junction box under the panel(s). Remove the cover(s) and locate the terminal block. Figures 6 and 7 show typical junction box configurations. Diode arrays are included to prevent unwanted power feedback.

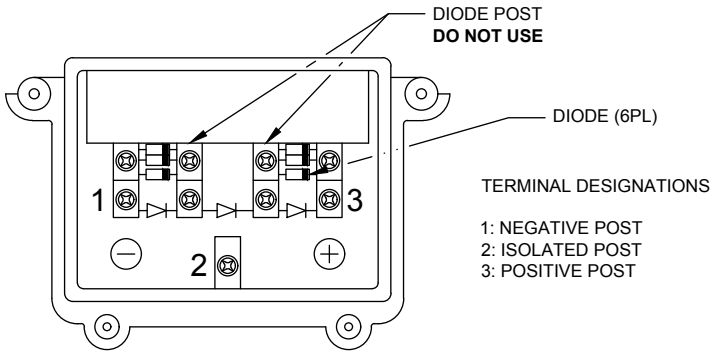


Figure 6 - Solar Panel Connections (Type 'M' Junction Box)

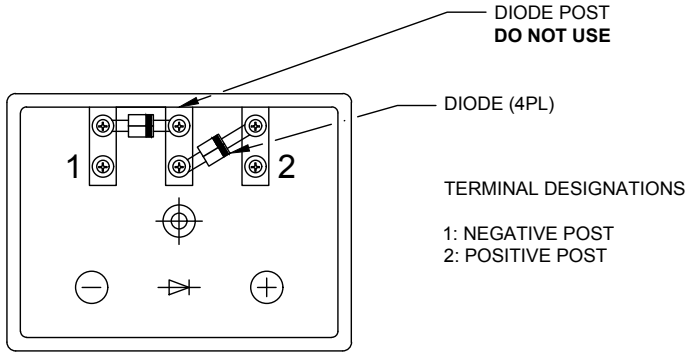


Figure 7 - Solar Panel Connections (Type 'G' Junction Box)

NOTE: if more than one panel is being used, connect the panels in parallel by installing a red jumper between the positive terminals and a black jumper between the negative terminals (Figures 8 and 9).

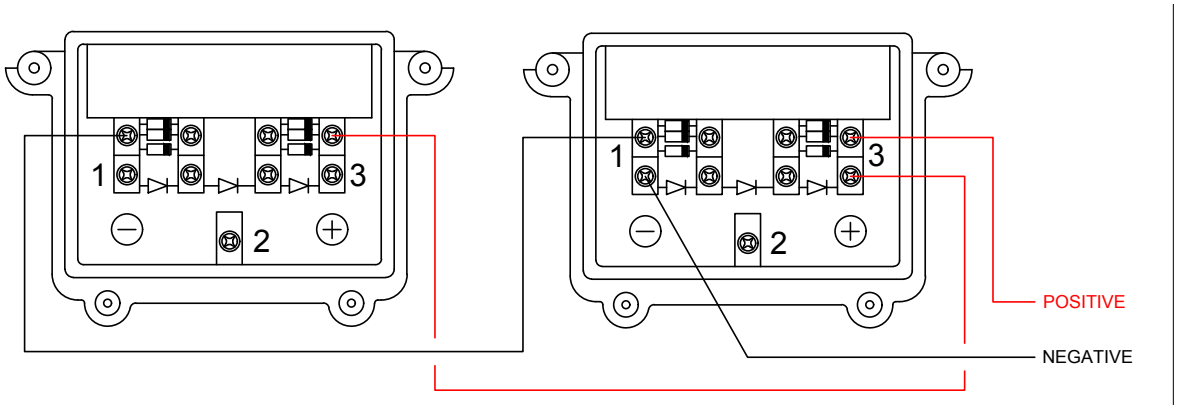


Figure 8 - Two Type 'M' Junction Boxes in Parallel

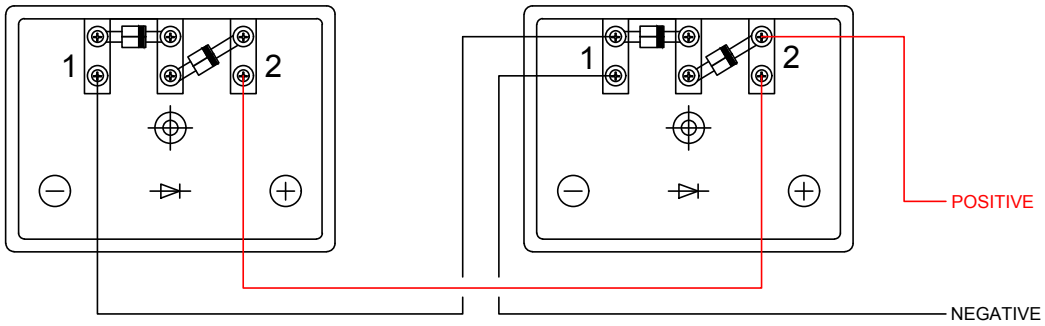


Figure 9 - Two Type 'G' Junction Boxes in Parallel

Earlier you installed the battery cabinet and inserted the solar panel lead (jacketed grey cable into the pole) and fished it out the top of the pole. Now insert the two cables in the jacketed cable into the solar panel junction box. The white lead goes to the positive connection and the black lead goes to the negative connection.

After making this connection, you have now completed the wiring connections from the solar panel to the solar controller. Fuses should remain disconnected until just prior to system checkout. If you did not install the pole into the base earlier, do so now. Refer to the previous section ‘Installing the Pole’.

Installing the LEDs

(NOTE: This section may be skipped if LEDs are not being installed)

Warning: Remove the fuse marked load inside the battery cabinet prior to connecting the LED(s).

If you have already drilled the pole for the LEDs then skip the next paragraph. If you have not drilled the holes for the LED, you will need to do so at this time.

ELTEC provides mounting hardware pre-selected for the LEDs that we provide. Normally this mounting hardware includes a hub which mounts to the pole either through U-bolts or banding. In many instances, our dealers provide the signal heads and mounting hardware. Should the mounting hardware differ from what is described in this section, please contact the dealer who sold you the system for installation details.

Pull the leads previously fished from the battery cabinet to the LED holes in the pole through the mounting hub. Insert the U-bolts around the pole and through the hub provided. Install the nuts and tighten.

Open the LED assembly door so that you have access to the inside of the signal housing. Decide if you are going to install the signal housing with the support on the bottom or on top of the housing. Install the signal closure kit (aluminum/plastic stopper) in the end of the housing which will not be used for support.

Feed the leads through the mounting hardware into the housing. Install the locking ring onto the threads of the mounting hardware and tighten. The signal housing should be positioned in the desired direction before tightening.

Normally the LED lens will be mounted in the signal housing when you receive the assembly. The signal housing should be mounted so that the ‘top’ of the LED lens is in the ‘up’ position.

Connect the LED leads to the terminal block in the signal housing. The red lead will go to the positive terminal and the black lead will go to the negative terminal.

Finally, close and secure the signal housing door.

Connecting the Battery(s)

Warning: Remove the battery fuse in the battery cabinet prior to connecting the battery(s).

If you have been provided with more than one (1) battery, you will also have red and black jumpers with ring terminals to connect the batteries in parallel. Unscrew the wing nuts from the battery terminals and attach the rings to the battery connection. The red jumper goes to the positive terminal and the black jumper goes to the negative terminal.

Thread the red and black wires of the backbone harness through the hole in back left corner of the control compartment in the battery cabinet. These wires should have rings on the ends of them. Unscrew the wing nuts off the battery terminals and attach the red wire to the positive terminal of the battery and the black wire to the negative terminal of the battery.

Final Connections and System Checkout

You should perform system checks to ensure that your wires and connections have been made correctly by referring to Appendix A. These checks should be written down by the installer for technical support purposes.

After you have completed your wire connections, connect the backbone harness assembly from the solar panels and battery to the circular pin connector located at the control panel. Re-install all fuses. There are three (3) fuses: the load fuse, the battery fuse, and the solar panel fuse.

The ProStar controller should have a status LED illuminated indicating that battery voltage is present at the controller. If all wiring has been made correctly, the display will also cycle ProStar controller. You should see battery voltage with a reading greater than 11.4 volts, array current, and load current. You will have to wait 2 minutes after system initialization before the load current is displayed. If the load is not turned on, the reading will be 0.0 amps. Refer to the provided manual for the ProStar controller LED section to ascertain battery charge state.

If your system has a time clock, the display should be active. The clock cycles through several displays which show date, time, flasher status, and program running. If you have ‘power fail’ showing on your time clock, simply push the button on the key pad marked ‘C’. This should reset the time clock.

Your time clock relay can be activated manually. To manually switch the relay on and off follow the command guide provided on the front of the clock.

Refer to Appendix D for troubleshooting your system. If you still have problems with system operation, please call ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com.

Section 3
Appendices

APPENDIX A - *(Fill in at the time of installation. Please print legibly.)*

*Technician:*_____ *Date:*_____

*Company Name:*_____

Critical Parameters

System Designation and Model Number: _____

Solar Panel Tilt Angle (From the Horizon): _____

Solar Panel Azimuth: _____
(180° is Due South in the Northern Hemisphere, and 0° is Due North in the Southern Hemisphere)

Pre-Turn On Checks

1. On the solar panel leads, check the voltage between the two leads. This voltage should read approximately 16-20 volts with proper sunlight. Your reading is _____.

2. On the terminal block marked 'BAT+' and 'BAT-' check the voltage between the 2 terminal blocks. This voltage should read between +11.4 volts and +13.7 volts. Your reading is _____.

Post-Turn On Checks

1. Verify the LED that is lit on the solar controller. Record the color of the LED that is lit _____.

2. Record the solar voltage being displayed on the controller _____V. (ProStar models only)

3. Record the array current being displayed on the controller _____amps, the time of day _____ and weather status (sunny, cloudy, raining) _____. (ProStar models only)

4. Turn on the load and record the load current being displayed on the controller _____amps. (ProStar models only)

APPENDIX B

Solar Panel(s)

The power output of your solar panel is proportional to sunlight intensity. It is important to install your solar panel so that it is not shaded during daylight hours. In the Northern Hemisphere your panel should be facing 180° Azimuth (directly South). Solar panels should also be tilted with respect to your known location. The optimal tilt angle can be determined in this section (see Figure 11) and recorded in Appendix A.

Figure 10 shows examples of tilt angles for solar panels. The angle to choose is the angle from the horizontal plane. Figure 11 (map) shows regional latitudes for North America. Optimal tilt angles for solar panels correspond with regional latitude.

A general 'rule of thumb' is to use a horizontal tilt angle of 60° if you are located in a region above the 40th parallel and 45° if you are in a region below the 40th parallel (See Figure 10). If you are uncertain about the best tilt angle, you should contact ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com

Solar panels are composed of crystalline cells interconnected to effect the wattage rating of the panel. Furthermore the connection is such that damage to single cell(s) only reduces the output of the panel by the power lost from the cell(s). Thus if only one cell is damaged your panel will still continue to produce power close to the rated output of the panel. The crystalline cells are encapsulated between tempered glass and an EVA (ethylene vinyl acetate) pottant with PVF (polyvinyl fluoride) back sheet to provide the maximum protection from environmental factors. The panel is housed in an anodized aluminum frame for strength and ease of handling.

Typical output ratings of panels are shown in Table 1.

Panel Rating	I Typical	V Typical	I Short Circuit	V Open Circuit
30 Watt	1.78	16.8	1.94	21.0
40 Watt	2.37	16.8	2.58	21.0
50 Watt	2.97	16.8	3.23	21.0
55 Watt	3.33	16.8	3.69	21.0
60 Watt	3.56	16.8	3.87	21.0
65 Watt	3.77	16.8	4.06	21.0
70 Watt	4.14	16.8	4.35	21.0
75 Watt	4.54	16.8	4.97	21.0
80 Watt	4.75	16.8	5.17	21.0
85 Watt	4.97	16.8	5.30	21.0
140 Watt	7.91	17.8	8.68	22.0

Table 1

If you have multiple panels they will be connected in parallel. The total typical current out will be multiplied by the number of panels in your array.

APPENDIX B (continued)

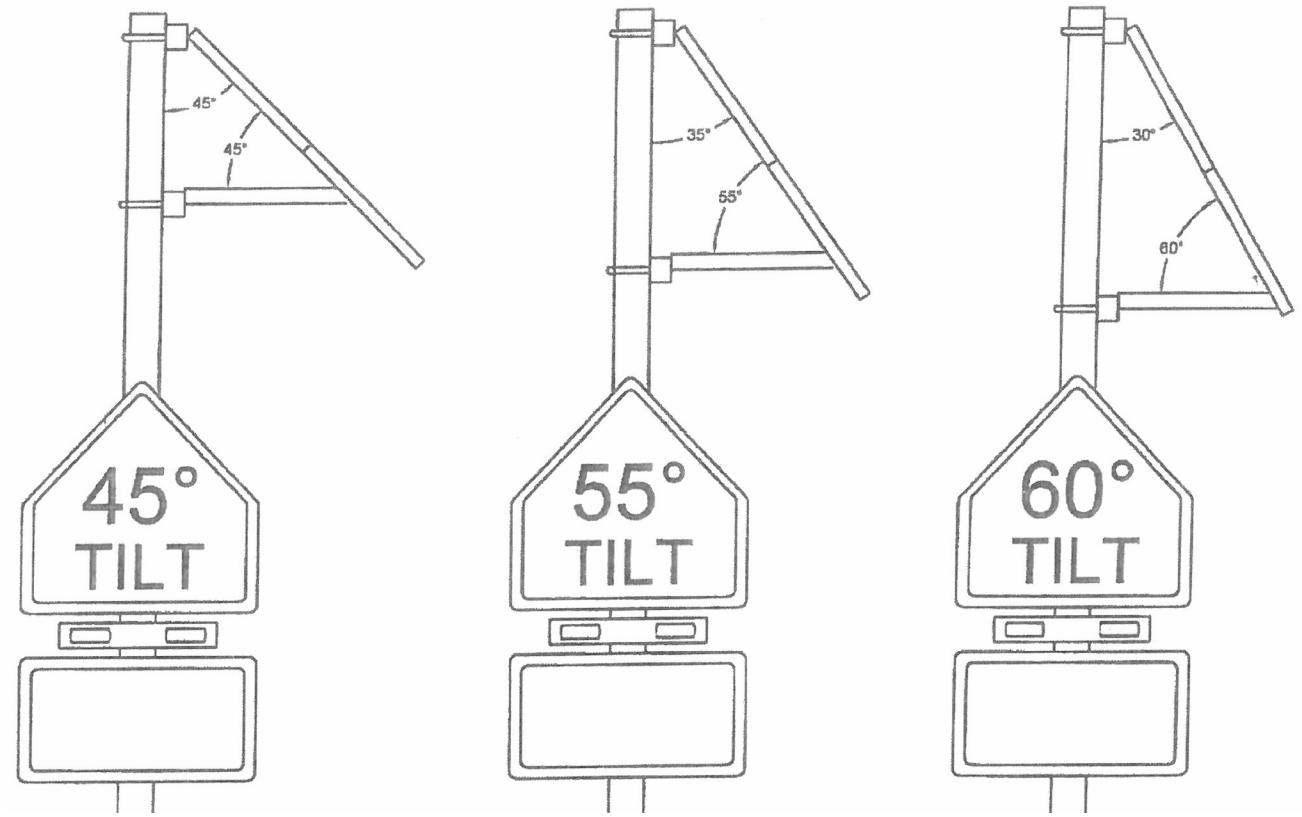


Figure 10 - Solar Panel Tilt Angles

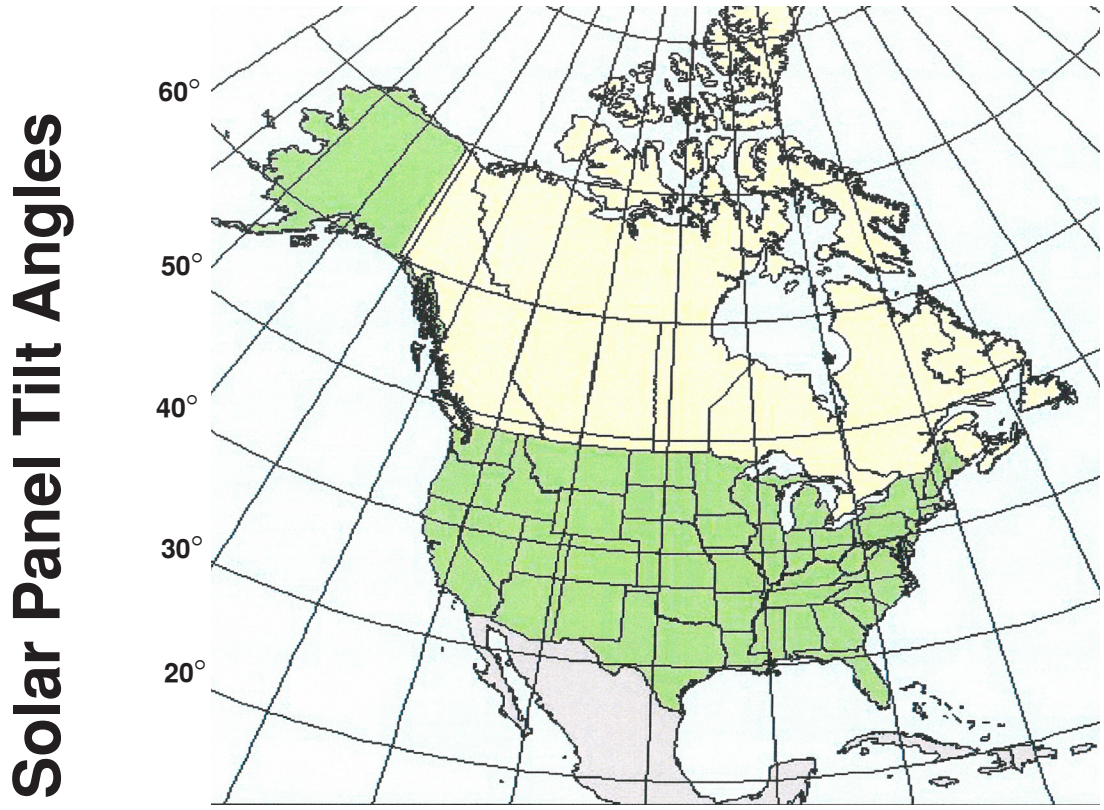


Figure 11 - North American Latitude Map

APPENDIX C

Preparation of the Foundation

Caution: This appendix is provided for reference only. Electrotechnics Corporation is not licensed to provide engineering services in your state. You should consult a licensed professional engineer for approval of your plans and your site.

The concrete foundation should be sufficiently sized to allow the installation of the anchor bolts or anchor cage and base. The base will typically be (13¾ x 13¾) inches if supplied by ELTEC. (See Figure 12)

Figure 13 depicts a typical pole foundation. Usually the foundation is square although it can also be circular. Remember that the foundation will house the anchor bolts or anchor cage to which the breakaway base mounts. The foundation must have a size that will accommodate the breakaway base, which should be at least a square that is (2 x 2) feet, or if circular it should have a diameter of at least 2 feet.

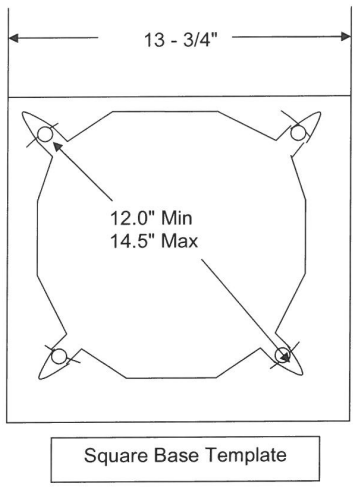


Figure 12

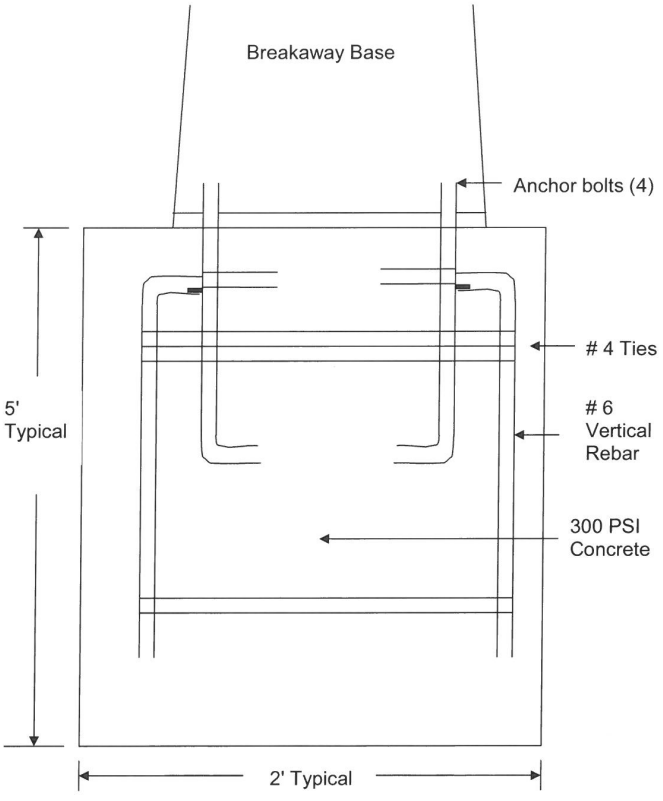


Figure 13

APPENDIX D

Troubleshooting

If the troubleshooting guide does not enable you to resolve your problem, please call ELTEC at 800-227-1734/ 903-938-1901 or email company@elteccorp.com

No LEDs are lit on Solar Controller (ProStar)

Verify with a multimeter that you have voltage at the battery connection to the controller. If you have voltage of at least 11.5 volts DC, press the ‘on/off’ (large button in upper right corner of controller).

Lights do not Flash - School Zone System

Verify that the red LED on the controller is not lit with a solid display. If it is flashing, your lights should be flashing if wired correctly, but the flashing means that your battery voltage is low.

Verify that your time clock has an active display and is scrolling messages on its display. Validate that your wiring is correct by turning on the beacons manually with the toggle switch. If that works, now try manually activating the lights from the clock keypad. On the clock keypad follow the prompts to manually turn on lights. If the lights still do not come on, then you have a problem with the wiring. If they do come on, verify that your program in your time clock is correct.

Check that the wiring in the LED head is positive to positive. The leads in the backbone harness should be marked ‘+’ and ‘-’. If you have a two beacon system, then you should also have a red jumper that goes from the positive terminal in one head to the positive terminal in the other head.

If the wiring is correct, verify that you have 12+ volts across the terminals in the head.

Lights do not Flash - 24 Hour System

Verify that the red LED on the controller is not lit with a solid display. If it is flashing, your lights should be flashing if wired correctly, but the flashing means that your battery voltage is low.

Ensure that the toggle/key switch is in the ‘on’ position.

Check that the wiring in the LED head is positive to positive. The leads in the backbone harness should be marked ‘+’ and ‘-’. If you have a two beacon system, then you should also have a red jumper that goes from the positive terminal in one head to the positive terminal in the other head.

If the wiring is correct, verify that you have 12+ volts across the terminals in the head.

Battery Voltage is Low or Low Voltage Disconnect is 'On' (ProStar)

If the low voltage disconnect is not ‘on’, verify that the solar panels are charging the batteries. Read the LCD display on the controller. The array current will be displayed as the display cycles through its displays. Use the table in Appendix B to approximate what the array current should be on a sunny day. If the array current is not approximate to expected value, then you most likely have a problem with your solar panel(s). Check your wiring at the panels (in the junction boxes) to ensure that the wiring to the battery cabinet and the jumpers from panel to panel are correct. If they are correct, then measure the voltage at the controller (PV + and PV -) to ensure that you have at least 16 volts present. If voltage is present, then the controller may be bad.

APPENDIX E

FS-2A Specifications

ELECTRICAL

- Input Voltage Range.....11.4 VDC to 30 VDC
- Max Load Power.....40 Watts per output circuit at 11.4 VDC to 30 VDC
- Operating Temp.....-20°C to +74°C

PHYSICAL DIMENSIONS

- Length.....5.5”
- Width.....2.625”
- Height.....1.64”

FUNCTIONALITY

- Flash Rate.....User Programmable for 35 to 70 flashes per minute.
- Flash Circuit.....User selectable via internal jumper for 1 or 2 circuits.
- Night Dimming....Automatic via Photocell (may be disabled).
- Night Run Only....User selectable via internal jumper for Disabled or Enabled.
- Lamp Type.....User selectable via internal jumper for Halogen or LED.
- Duty Cycle.....User selectable via internal jumper for 40% on 60% off flash cadence (single circuit mode) or it may be set to 50% on/off.

The FS-2A is entirely microprocessor controlled which gives it tremendous versatility and low power consumption. The FS-2A is intended for use in solar power applications, or in any application where there is a ready source of 11.4 VDC to 30 VDC.

Flash Options

To program the FS-2A you first need to remove the case cover. With a Phillips screwdriver, remove the two black cover retaining screws and set them aside. The cover should easily slide off. Near one end of the printed circuit board (opposite the harness connection) you should see a row of jumper pins. Figure 14 shows pin rows and columns.

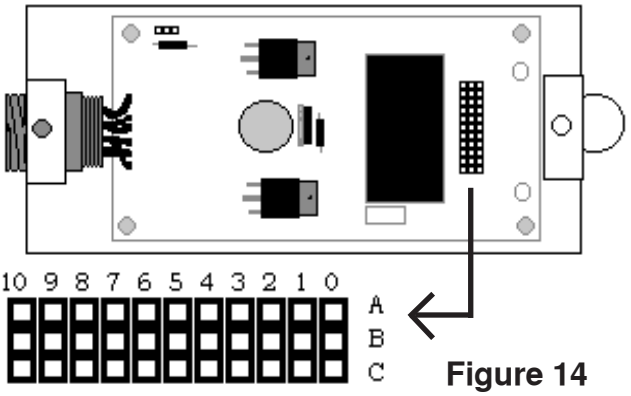


Figure 14

Tables 1 and 2 show the jumper settings for each option. Table 1 contains the general pin settings and Table 2 contains the flash rate pin settings.

NOTE: Jumped pins are shown as shaded blocks in the examples. A jumper across pins A and B = OFF. A jumper across pins B and C = ON.

APPENDIX E (continued)

GENERAL PIN SETTINGS

PIN	ON (BC)	OFF (AB)
0	2 CIRCUIT FLASHER	1 CIRCUIT FLASHER
1	40% ON 60%OFF *	50% ON/OFF
2	DIM ENABLED	DIM DISABLED
3	NIGHT RUN ENABLED	NIGHT RUN DISABLED
4	LED LAMPS	HALOGEN LAMPS
5	NOT USED	
6	NOT USED	
7	NOT USED	

AB = OFF
BC = ON

Table 2

**40% ON 60% OFF only work in one-circuit mode.*

FLASH RATE PIN SETTINGS

	FLASHES PER MINUTE							
	35	40	45	50	55	60	65	70
8	ON	OFF	ON	OFF	ON	OFF	ON	OFF
9	ON	ON	OFF	OFF	ON	ON	OFF	OFF
10	ON	ON	ON	ON	OFF	OFF	OFF	OFF

AB = OFF
BC = ON

Table 3

PIN EXAMPLES- (JUMPED PINS ARE SHADED BLOCKS)

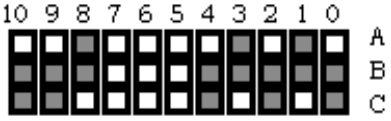
EXAMPLE 1 - FLASHES PER MINUTE

FLASH RATE = 45 FLASHES/MIN

FLASH RATE = 60 FLASHES/MIN

EXAMPLE 2

- 2 circuit operation
- 50% on/off
- Dim enabled
- Night Run disabled
- LED type lamps
- Flashing at 40 flashes/minute



EXAMPLE 3

- 1 circuit operation
- 40% on 60% off
- Dim enabled
- Night Run enabled
- Halogen type lamps
- Flashing at 55 flashes/minute

APPENDIX E (continued)

Control Options

1. Continuous Flash (operates 24 hrs/day when power is applied to Red and Black wires)
2. Relay/Switch Controlled Flash(operates when Yellow is grounded to White/Yellow wires)

A smaller set of jumpers is located at the opposite end of the circuit board, near the harness connection. These 3 pin jumpers allow you to select continuous flash or relay/switch controlled operation (See Figure 15).

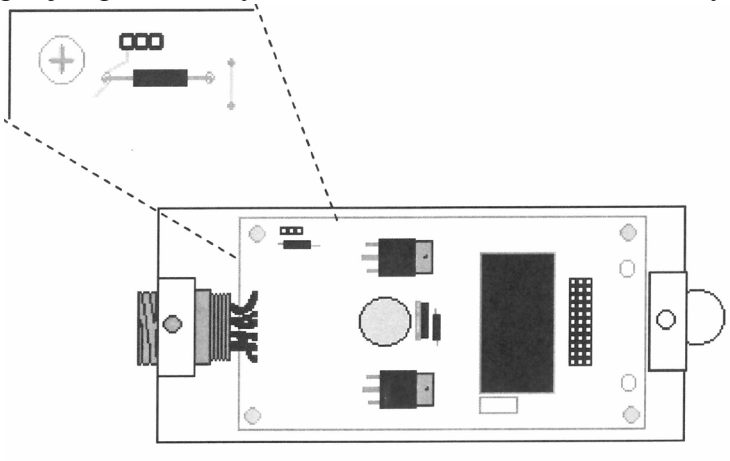
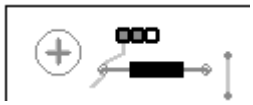


Figure 15

Continuous Flash



(JUMPED PINS ARE SHADED)

Jumper the 2 pins closest to the corner edge of the circuit board for continuous flash mode. If the flasher is set to continuous flash it will ignore any switches or relays which may be connected.

Relay/Switch Controlled Flash

(JUMPED PINS ARE SHADED)

Jumper the 2 pins away from the corner edge of the circuit board for Relay/Switch control mode. In this mode, the flasher will operate only if the controlling relay or switch is closed(yellow wire grounded). The switch or relay must be connected across pin 7 (Yellow) and pin 9 (White/Yellow) of the CPC harness.

WARNING: Never apply voltage to the (Yellow) control input wire.

(See Figure 16 for Flasher Wire/Connector Pin Out designation.)

After programming is finished, replace flasher cover and screws.

APPENDIX E (continued)

Night Dimming Functionality

When your flasher is set for night dimming it will constantly evaluate the brightness of light at the photocell. It will not react to brief increases or decreases in light levels, such as a passing car headlights or someone walking by the photocell. A built-in filter constantly averages the amount of light appearing at the photocell. This light level must change for a number of seconds before the filter will trigger a change in signal intensity.

If the filter detects that the light level at the photocell has changed and has remained changed for several seconds, then it will begin dimming the lamps proportional to light level in steps beginning at 80% then 60% and so on, down to 33% (full dim). The unit should reach full dim at around 2 Foot-Candles +/- 10%.

If you cover the photocell to test the dimming it may take more than a minute for it to reach full dim. When exposed to light after being at full dim, the lamp intensity will be increased from 33% up to 100% (full bright) at about the same rate.

FS-2A Limited Warranty

Electrotechnics Corporation (d.b.a ELTEC) warrants devices manufactured by ELTEC to be free of defects in material and workmanship for a period of 25 months from the date of purchase by the original purchaser.

To determine if the FS-2A is within warranty, locate the serial number (SN) on the white decal. The letter determines the month (A-L=January through December) it was manufactured followed by the year. Example: C12xxxxx=March '12.

ELTEC will repair or replace any FS-2A flasher returned prepaid within the warranty period as long as there is no evidence that the unit has been misused, abused, damaged by input over voltage, output overloads, lightning, or water, or altered in any manner without the expressed written permission of ELTEC. ELTEC disclaims any warranties expressed or implied, including warranties of merchantability and/or fitness for a particular purpose. In no event shall ELTEC be held liable for incidental or consequential damages. Warranty repairs will be handled during normal business hours. Ship flasher requiring warranty service to:

ELTEC
1310 Commerce St.
Marshall, TX 75672
U.S.A.

Products requiring repair or warranty service must have a RETURN MATERIAL AUTHORIZATION number (R.M.A.)

1) Before returning any flasher, contact ELTEC's Technical Support Staff at 800-227-1734/ 903-938-1901, or company@elteccorp.com to receive a RMA number.
2) Fill out the Return Material Authorization form in its entirety. The form is available at **www.ELTECCORP.com** under the Tech Support tab.
3) Return the authorized item(s) per shipping instructions seen below.

Shipping instructions:

1) Make sure you include all item(s).
2) Pack item(s) carefully to avoid damage in transit.
3) Place the RMA form in box (we recommend you make a copy for your records).
4) Label each box with the valid RMA number on the outside. It must be recognizable.

APPENDIX E (continued)

Wire/Connector Pin Outs

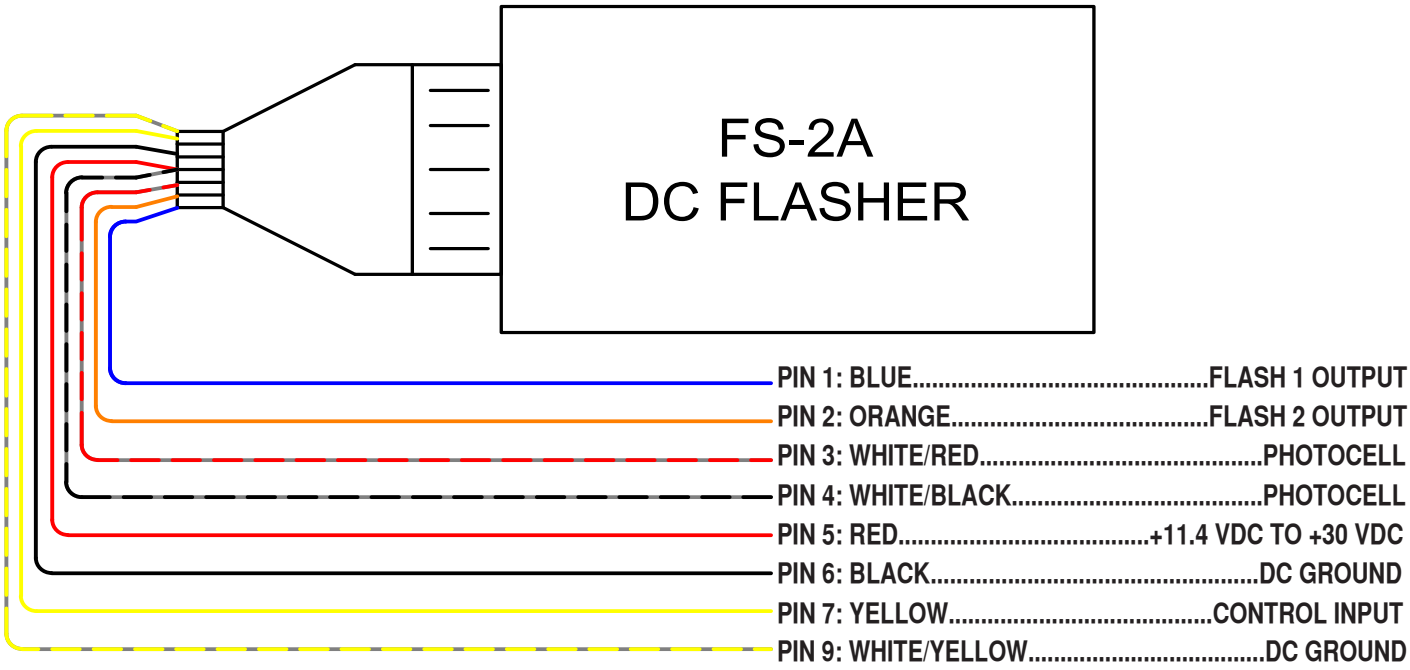


Figure 16